SEAFLOOR ACOUSTIC PROPERTIES, TEST BED DEFINITION, GEOLOGIC MAPPING AND SEDIMENTARY PROCESSES USING AUV TECHNOLOGY

PI: Dawn Lavoie
Naval Research Laboratory
Stennis Space Center MS 39529-5004
voice: (601) 688-4659 FAX: (601) 688-5752
e-mail: lavoie@zephyr.nrlssc.navy.mil
Award #N0001497WX30378

Kevin Briggs
voice (601) 688-5310 FAX: (601) 688-5752
e-mail: kbriggs@zephyr.nrlssc.navy.mil

Michael Richardson
voice: (601) 688-4621 FAX: (601) 688-5752
e-mail: miker@zephyr.nrlssc.navy.mil

INTRODUCTION

The work funded under this title is a joint effort between the University of South Florida (Drs. A. Hine, D. Naar and S. Locker) and Florida Atlantic University (Dr. S. Schock). The collaboration between our three groups has allowed us to make the most efficient use of our various expertise, and field and laboratory operations. This year end report applies only to the Naval Research Laboratory efforts.

GOALS

Long term goals are to (1) to develop/improve inversion techniques for normal incidence sediment classification systems and remotely determine sediment physical and geoacoustic properties; (2) determine mechanisms responsible for scattering of high frequency energy.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 1997		**00-00-1997 to 00-00-1997**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Seafloor Acoustic Properties, Test Bed Definition, Geologic Mapping and Sedimentary Processes Using AUV Technology	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval Research Laboratory,Stennis Space Center,MS,39529**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**4**	

OBJECTIVES

Our short term objectives in FY97 were to continue to quantify and correlate geoacoustic and physical properties of the sediments with similar property data acquired by the acoustic classification systems tested on the FAU UUV (specifically FAU's CHIRP and sidescan sonar systems). Specifically, NRL's objective in the field efforts has been to provide sediment physical and acoustic properties data *in situ* and from core samples, and bottom roughness from stereo photographs of the seafloor.

APPROACH

During FY97, NRL has concentrated on measuring geoacoustic and physical properties data from the Dry Tortugas test site using in situ shear and compressional wave probes and standard laboratory procedures on cores-collected sediments. These data are being used for empirical modeling of the acoustic data with respect to the physical properties and for test bed development for AUV calibration and testing as well as for comparison with AUV-collected sediment data. NRL has also characterized the sediment interface by estimating the roughness power spectra from digitized stereo photography of the sea floor. The composite roughness model is used to predict backscattering from impedance contrast data (compressional wave velocity and density ratios), sediment volume scattering contributions, and one-dimensional roughness power spectra. NRL will use its stereo comparator to generate digitized microtopography from seafloor stereo photographs. Roughness power spectra will be generated from these profiles of seafloor microtopography and regressed on a log-log scale to yield the spectrum slope and intercept. These parameters, together with sediment properties, are used to determine the level of acoustic backscatter.

WORK COMPLETED/RESULTS

Laboratory analyses from FY96 cores were completed. In addition, the FY97 field experiments in the Dry Tortugas, particularly the North Key Harbor test site, provided quantitative data on bottom geoacoustic and physical properties. The physical properties analyses, including void ratio, porosity, density, grain density, grain size distribution,permeability, compressional and shear wave velocity and attenuation, have

been completed. Preliminary data have been presented and published (see below) but modeling efforts are ongoing.

IMPACT

Results from this project will result in better understanding and improved inversion techniques for normal incidence sediment classification systems. In addition, the acoustic community can use empirical relationships derived for deriving modeling input parameters.

TRANSITIONS

Results from this project are being transitioned to the NRL 6.2 Mine Burial Project in the form of improved bottom characterization for burial models. Ground truth data from this project have been provided to and used by other programs (e.g., NRL's Acoustic Sediment Classification System funded by Navoceano, D. Lambert, PI).

RELATED PROJECTS

This project has taken advantage of the Coastal Benthic Boundary Layer resources, particularly during the Key West cruise which was funded entirely by the CBBL (M. Richardson, chief scientist). The FY97 field experiment was leveraged from the NRL 6.1 core program (Herb Eppert, manager). The data are supporting the ONR-funded Quantitative Chemical Mass Transfer in Coastal Sediments during Early Diagenesis (Dr. J. Kravitz, program manager).

REFERENCES

Lavoie, D.L., M.D. Richardson, and C. Holmes. 1997. Benthic Boundary Layer Processes in the Lower Florida Keys. Geo-Marine Letters Special Issue, v17, no. 4 (in press)

Furukawa, Y., D. Lavoie and K. Stephens. 1997. The effect of geochemical diagenesis on sediment structure and mineralogy in shallow marine carbonate sediments near the Dry Tortugas, Florida, Geo-Marine Letters Special Issue, v17, no. 4 (in press)

Mallinson, D., S. Locker, M. Hafen, D. Naar, A. Hine, D. Lavoie, S. Schock. 1997. A high resolution geological and geophysical investigation of the Dry Tortugas carbonate depositional environment.Geo-Marine Letters Special Issue, v17, no. 4

(in press)

Richardson, M.D. 1997. In situ, shallow water geoacoustic properties. International Conference on Shallow-water Acoustics, Beijing, China. 10 p.

Stephens, Kevin, D. Lavoie, K. Briggs, Y. Furukawa, and M. Richardson, 1997, Geotechnical and Geoacoustic Properties of Sediments off South Florida: Boca Raton, Indian Rocks Beach, Lower Tampa Bay, and the Lower Florida Keys, NRL/MR/7431--97--8042, 303 pp.

Stephens, K., D. Lavoie, and P. Fleischer. 1997. Physical and Geoacoustic Property Variability of Recent, Shallow-water Carbonate Sediments from the Dry Tortugas Keys, Florida. Geo-Marine Letters Special Issue, v17, no. 4 (in press)

Walter, D., D.N. Lambert, D.C. Young, D.L. Lavoie and K. Stephens. 1997. Acoustic Mapping of Seafloor Properties in a Shallow-Water Carbonate Environment with Comparisons to Core Data, Geo-Marine Letters Special , v17, no. 4 (in press)

Lavoie, D, D.J. Walter, K. Stephens, A Comparison of Acoustically-predicted Sediment Properties with Laboratory-Measured Core Data, February 1997 MAS (abstract, presentation)